

In the Claims

The claims in their present state are set forth below.

1. (Previously Amended) Apparatus for conditioning an edge of a stack of a plurality of sheets to be bound comprising:

a stack clamping mechanism configured to secure the stack of sheets;

a piercing member configured to produce piercing member movement, with said piercing member movement being substantially limited to a single piercing plane;

a positioning mechanism configured to control a relative movement of the stack clamping mechanism and the piercing mechanism so that the sheets of the stack pass through the piercing plane; and

a drive mechanism configured to drive the piercing member into the edge of the stack at least once for each sheet of the stack passing through the piercing plane.

2. (Previously Amended) The apparatus of Claim 1 wherein the sheets of the stack of sheets each define a sheet plane in a region near the edge of the stack and wherein the positioning mechanism causes the sheet planes to substantially coincide with the piercing plane when the stack passes through the piercing plane.

3. (Previously Amended) The apparatus of Claim 2 wherein the sheets of the stack each have an approximate thickness of N units and wherein the drive mechanism is configured to drive the piercing member into the stack at least once for every N units of relative movement of the stack and piercing member.

4. (Previously Amended) The apparatus of Claim 3 wherein the drive mechanism is configured to drive the piercing member into the stack approximately twice every N units of the relative movement.

5. (Previously Amended) The apparatus of Claim 1 wherein the piercing member includes a plurality of separate piercing elements, with each of the piercing elements having a cutting edge disposed in the piercing plane.

6. (Original) The apparatus of Claim 5 wherein the drive mechanism further includes a support member, said support member being pivotally mounted at a first location on the support member and with said support member securing the piercing member at a second location spaced apart from the first location, with said support member being pivoted about the first location so that the piercing member is moved between a withdrawn position and a piercing position.

7. (Original) The apparatus of Claim 6 wherein the stack clamping mechanism is configured to secure the stack of sheets so that the edge of the stack is positioned along a support plane, with the piercing member being disposed on one side of the support plane in the withdrawn position and with the piercing member extending past the support plane at least a distance of 0.01 inches into another side of the support plane in the piercing position.

8. (Previously Amended) The apparatus of Claim 5 further including a multiplicity of said piercing members, with the piercing movement of each of the piercing members being substantially in the piercing plane.

9. (Original) The support member of Claim 8 wherein the drive mechanism further includes a support member associated with each of the piercing members, each of said support members being pivotally mounted at a first location on the support member and with said support member securing the associated piercing member at

a second location spaced apart from the first location, with said support members being pivoted about the first location so that the associated piercing member is moved between a withdrawn position and a piercing position.

10. (Previously Amended) The apparatus of Claim 9 wherein the stack clamping mechanism is configured to secure the stack of sheets so that the edge of the stack is positioned along a support plane, with the piercing members being disposed on one side of the support plane in the withdrawn position and with the piercing members extending past the support plane at least a distance of 0.01 inches into another side of the support plane in the piercing position.

11. (Previously Amended) The apparatus of Claim 10 wherein the drive mechanism is configured to sequentially drive each of the piercing members so that the piercing members arrive at the piercing position at a differing point in time so that one of the piercing members arrives at the piercing position at a time different than another one of the piercing members.

12. (Original) The apparatus of Claim 11 wherein the drive mechanism includes a camshaft having a separate cam surface associated with each of the support members, with the cam surfaces engaging associated cam follower bearings mounted on the support members.

13. (Original) The apparatus of Claim 11 wherein the drive mechanism includes a drive shaft and a converting mechanism for converting a rotational motion of the drive shaft into reciprocating motion to drive each of the support members.

14. (Original) The apparatus of Claim 13 wherein the drive mechanism includes a crank assembly driven by the drive shaft and a connection assembly associated with each of the support members connecting the crank assembly and the associated support member.

15. (Original) The apparatus of Claim 1 wherein the piercing member includes at least one ceramic cutting element.

16. (Original) The apparatus of Claim 15 wherein the piercing member includes a multiplicity of separate ones of the cutting elements.

17. (Previously Amended) Apparatus for conditioning an edge of a stack of sheets to be bound comprising:

- a stack clamping mechanism configured to secure the stack of sheets, with at least a region of the sheets of the stack near the edge being parallel to a piercing plane;

- a piercing member including a piercing edge movable substantially exclusively in the piercing plane;

- a positioning mechanism configured to control relative movement of the stack clamping mechanism and the piercing member; and

- a drive mechanism configured to cause the piercing edge to reciprocate in the piercing plane between a withdrawn position displaced from the stack and a piercing position contacting the stack at least once for every sheet in the stack.

18. (Original) The apparatus of Claim 17 wherein the piercing edge includes ceramic.

19. (Previously Amended) The apparatus of Claim 17 wherein said piercing member includes a plurality of spaced apart ones of the piercing edges, with all of the piercing edges moveable substantially in the piercing plane.

20. (Previously Amended) The apparatus of Claim 17 further including a plurality of the piercing members, with each of the piercing members including a multiplicity of the piercing edges, with the piercing edges movable substantially in the piercing plane and wherein the driving mechanism is further configured to cause each of the

piercing members to be sequentially reciprocated so that the piercing edges of each of the respective piercing members contact the stack at differing points in time so that one of the piercing members contacts the stack at a time different than another one of the piercing members.

21. (Original) The apparatus of Claim 20 wherein the piercing edges include ceramic.

22. (Previously Amended) Apparatus for conditioning a stack of sheets to be bound comprising:

- a stack clamping mechanism configured to secure the stack of sheets, with at least a region of each of the sheets of the stack near the stack edge defining respective outer parallel sheet planes, with all of the sheets of the stack being disposed intermediate said sheet planes and with said sheet planes being normal to a stack edge plane disposed at the stack edge;

- a piercing member including a piercing element, with said piercing element movable substantially exclusively in a single piercing plane;

- a positioning mechanism configured to control relative movement of the stack clamping mechanism and the piercing plane so that the sheet planes of each of the sheets sequentially pass through, and become momentarily, substantially coincident with, the piercing plane; and

- a drive mechanism configured to cause the piercing element to repeatedly engage the stack substantially exclusively through the stack edge plane and not through the sheet planes and to then disengage the stack substantially exclusively through the stack edge plane and not through the sheet planes during the relative moment.

23. (Previously Amended) The apparatus of Claim 22 wherein the piercing element comprises a multiplicity of separate cutting edges that move substantially in the piecing plane.

24. (Previously Amended) The apparatus of Claim 23 further including a plurality of the piercing members and wherein the drive mechanism is further configured to cause each of the respective piercing elements to sequentially engage and disengage the stack so that one of the piercing elements engages the stack at a differing point in time than another one of the piercing elements.

25. (Original) The apparatus of Claim 22 wherein the drive mechanism is configured to engage the stack at least once for every sheet that passes through the piercing plane.

26. (Previously Amended) A method of conditioning an edge of a stack of sheets to be bound, said method comprising:

- providing a piercing member;

- supporting the stack so that a compression force is applied to the stack in a region near the edge of the stack;

- periodically driving the piercing member into the edge of the stack in a first direction to engage the stack at a first location and withdrawing the piercing member from the first location at the edge of the stack in a second direction generally opposite the first direction; and

- moving the piercing member and the stack relative to one another at least once for each sheet of the stack so that each sheet of the stack is pierced by piercing member so that the edge of the stack is conditioned, with the conditioned edge being substantially linear before and after conditioning and with dimensions of the stack before and after conditioning being substantially constant.

27. (Previously Amended) A sheet conditioned in accordance with the method of Claim 26.

28. (Original) The method of Claim 26 wherein the piercing member includes a plurality of individual spaced apart piercing elements aligned along a common axis and wherein the periodically driving includes driving the piercing elements into the edge of the stack with the common axis being substantially parallel with the edge of the stack.

29. (Previously Amended) A sheet conditioned in accordance with the method of Claim 28.

30. (Previously Amended) Apparatus for conditioning an edge of a stack of sheets to be bound comprising:

- a stack clamping mechanism configured to secure the stack of sheets, with a region of the sheets near the edge lying within individual parallel sheet planes and with the edge of the stack being disposed in an edge plane generally normal to the sheet planes;

- a piercing member configured to produce a piercing action in a piercing direction;

- a positioning mechanism configured to control a relative movement of the stack clamping mechanism and the piercing member so that the sheet planes are substantially parallel to the piercing direction during such relative movement; and

- a drive mechanism configured to periodically drive the piercing member into the edge of the stack substantially exclusively through the edge plane so as to pierce the stack and to withdraw the piercing member from the edge of the stack substantially exclusively through said edge plane.

31. (Original) The apparatus of Claim 30 wherein piercing member includes a multiplicity of separate piercing elements and wherein said positioning mechanism and said drive mechanism are configured so that each sheet of the stack is pierced by at least one of the piercing elements.

32. (Previously Amended) The apparatus of Claim 30 where the positioning mechanism operates such that a longitudinal axis of the stack edge is generally orthogonal to a first axis and wherein the piercing member includes an array of separate piercing elements, with a number and lateral spacing of the piercing elements with respect to the first axis being such that each sheet of the stack is pierced by at least one of the piercing elements when the relative movement is along the longitudinal axis.

33. (Previously Amended) The apparatus of Claim 32 wherein the piercing elements are all disposed along a piercing axis, with the piercing axis and the longitudinal axis of the stack edge being aligned with respect to one another at no greater than an acute angle.

34. (Previously Amended) The apparatus of Claim 33 wherein the piercing axis and the longitudinal axis are at an angle that is at least one degree.

35. (Original) The apparatus of Claim 34 wherein the acute angle is less than 10 degrees.

36. (Previously Amended) The apparatus of Claim 33 further including a plurality of the piercing members, with each of the piercing members including a separate piercing blade, with each of the piercing blades including a multiplicity of the piercing elements aligned along the piercing axis and wherein the drive mechanism is further configured to drive each of the piercing members at differing points in time so that one of the piercing members is driven into the stack at a time different than another one of the piercing members.

37. (Previously Amended) Apparatus for conditioning an edge of a stack of sheets to be bound comprising:



a stack clamping mechanism configured to secure the stack of sheets, with a region of the sheets near the stack edge lying within individual parallel sheet planes and with the stack edge disposed in an edge plane generally orthogonal to the sheet planes;

a piercing mechanism including a plurality of piercing members, with each of the piercing members including a piercing edge aligned along a single piercing axis common to all of the piercing members, with each of the piercing edges capable of reciprocating movement in a piercing direction substantially parallel with the sheet planes;

a positioning mechanism configured to control a relative movement of the stack clamping mechanism and the piercing mechanism so that a longitudinal axis of the edge of the stack is disposed at no greater than an acute angle with respect to the piercing axis; and

a drive mechanism configured to periodically drive the piercing members so that the reciprocating movement causes the piercing edges to be driven at differing times into the edge of the stack so as to pierce the stack and away from the edge of the stack so that a first one of the piercing members engages the stack at a time different than a second one of the piercing members, with the piercing members entering and exiting the stack edge substantially exclusively through said edge plane.

38. (Original) The apparatus of Claim 37 wherein the piercing members are positioned along the piercing axis such that a spacing of the piercing members relative to an axis normal to the longitudinal axis is at least equal to a width of the sheets of the stack so that each sheet of the stack is pierced by at least one of the piercing members.

39. (Previously Amended) The apparatus of Claim 37 wherein the drive mechanism further includes a support member associated with each of the piercing members and wherein the drive mechanism is further configured to separately drive each of

the support members so that the piercing members engage the stack at differing points in time.

40. (Original) The apparatus of Claim 39 wherein the drive mechanism includes a drive shaft and reciprocating apparatus configured to convert rotational motion of the drive shaft to reciprocating motion.

41. (Original) The apparatus of Claim 40 wherein the reciprocating apparatus includes, for each of the support members, a cam surface and a cam follower engaging the cam surface.

42. (Previously Amended) The apparatus of Claim 40 wherein the reciprocating apparatus includes, for each of the support members, a crank assembly and a connecting assembly.

43. (Previously Amended) A method of conditioning an edge of a stack of sheets to be bound, said method comprising;

- providing an array of piercing members disposed along a common axis;

- supporting the stack so that a compression force is applied to the stack in a region near the edge of the stack, with the edge of the stack being substantially disposed in a single edge plane;

- periodically driving the piercing members into the edge of the stack substantially exclusively through said edge plane so as to pierce the stack and withdrawing the piercing members from the edge of the stack substantially exclusively through said edge plane a multiplicity of times; and

- moving the array of piercing members and the stack relative to one another so that each sheet of the stack is pierced by the piercing members.

44. (Previously Amended) The method of Claim 43 wherein the driving of the piercing members relative to the stack is such that the edge of the stack is linear

subsequent to the conditioning and wherein stack dimensions prior and subsequent to the conditioning are substantially unchanged.

45. (Previously Amended) A sheet conditioned in accordance with Claim 44.

46. (Previously Amended) The apparatus of Claim 1 further including a multiplicity of said piercing members, with the piercing movement of each of the piercing members being substantially in the piercing plane and wherein the drive mechanism is configured to drive at least some of the piercing members to the piercing position at a differing point in time with respect to one another so that one of the piercing members engages the stack at a time different than another one of the piercing members.

47. (Previously Amended) The apparatus of Claim 17 further including a plurality of the piercing members, with each of the piercing members including a multiplicity of the piercing edges, with the piercing edges movable substantially in the piercing plane and wherein the driving mechanism is further configured to cause the piercing members to be reciprocated at differing points in time so that one of the piercing members engages the stack at a time different than another one of the piercing members.

48. (Previously Amended) Apparatus for conditioning an edge of a stack of sheets to be bound comprising:

- a stack clamping mechanism configured to secure the stack of sheets, with a region of the sheets near the edge lying within individual parallel sheet planes, with the edge of the stack being substantially disposed in a single edge plane generally normal to the parallel sheet planes;

- a piercing member including a plurality of piercing elements, with each of the piercing elements having a cutting surface disposed along a common cutting plane,

with said piercing member being configured to produce a reciprocating action along a reciprocating axis, with the reciprocating axis being substantially parallel to the sheet planes;

a positioning mechanism configured to control a relative movement of the stack clamping mechanism and the piercing member; and

a drive mechanism configured to periodically drive the piercing member so that the piercing elements move along the reciprocating axis into the edge of the stack substantially exclusively through the edge plane and away from the edge of the stack substantially exclusively through the edge plane.

49. (Previously Submitted) The apparatus of Claim 48 wherein the cutting plane is disposed at an angle with respect to the sheet planes which is less than 10 degrees.

50. (Previously Submitted) The apparatus of Claim 48 further including a plurality of the piercing members, with each of the piercing members including piercing elements having a cutting surface disposed along a respective common cutting plane.

51. (Previously Submitted) The apparatus of Claim 50 wherein the respective common cutting planes of the plurality of piercing members are disposed in a common plane.

52. (Previously Amended) The apparatus of Claim 48 further including a plurality of the piercing members, with the drive mechanism being further configured to sequentially drive at least some of each of the piercing members into the stack at differing times so that one of the piercing members engages the stack at a time that differs from that of another one of the piercing members.

53. (Previously Submitted) A method of conditioning an edge of a stack of sheets to be bound, with a number of sheet in the stack determining a thickness of the stack, said method comprising:

- providing a piercing member;

- supporting the stack so that a compression force is applied to the stack in a region near the edge of the stack; and

- moving the piercing member and the stack relative to one another; and

- during the moving, periodically reciprocating the piercing member so that the piercing member is driven into the edge of the stack and away from the stack, with a number of reciprocations being dependent upon the thickness of the stack.

54. (Previously Submitted) The method of Claim 53 where the number of times is such that each sheet of the stack is pierced at least one during the driving.

55. (Previously Amended) The method of Claim 54 wherein a plurality of the piercing members is provided and wherein the periodically reciprocating includes driving at least some of the piercing members into and away from the stack at differing points in time so that one of the piercing members engages the stack at a time which differs from a time that another one of the piercing members engages the stack.

56. (Previously Submitted) Apparatus of conditioning an edge of a stack of a plurality of sheets to be bound comprising:

- a stack clamping mechanism configured to secure the stack of sheets so that the stack edge falls within an edge plane;

- at least one relatively rigid piercing member;

- a drive mechanism configured to drive the at least one piercing member into the stack edge so as to pierce the stack and to withdraw the at least one of the

piercing member from the stack edge substantially exclusively through the edge plane; and

a positioning mechanism configured to control relative movement of the stack clamping mechanism and the at least one piercing member so that each sheet of the stack is engaged at least once by the at least one piercing member.

57. (Previously Submitted) The apparatus of Claim 56 further including a plurality of the rigid piercing members and wherein the drive mechanism is further configured to drive the piercing members into the stack edge and to withdraw the piercing members from the stack edge substantially exclusively through the edge plane, with at least two of the rigid piercing members engaging the stack edge at differing points in time.

58. (Previously Submitted) A method of conditioning an edge of a stack of sheets to be bound, said method comprising:

supporting the stack of sheets by applying a compression force to at least the edge of the stack, with the edge of the stack being disposed in an edge plane; and repeatedly piercing the edge of the stack with a relatively rigid piercing member so that each sheet of the stack is contacted, with the piercing including contacting the edge of the stack substantially exclusively through the edge plane and including withdrawing from the edge of the stack substantially exclusively through the edge plane, with the edge of the stack being linear prior to and after the conditioning and with stack dimensions being substantially constant before and after the conditioning.

59. (Previously Submitted) A sheet conditioned in accordance with the method of Claim 58.